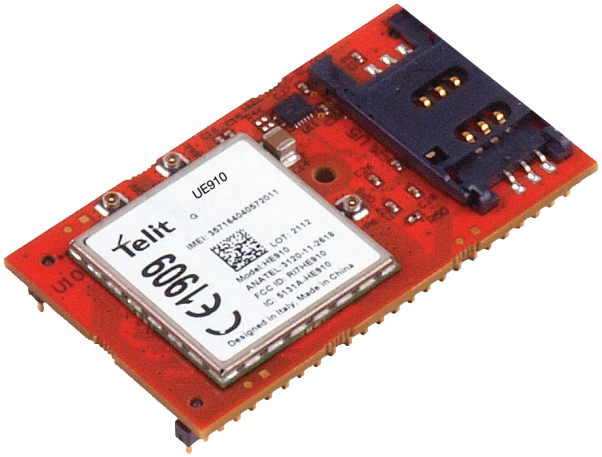
HSPA910CF v2.0 Terminus Plug-In Products User Manual



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1 APPLICABILITY TABLE

Product	Part Number
HSPA910CF	
HSPA910CF	v2.00

2 REFERENCES

2.1 Telit Document List

HSPA910CF

Our terminal uses Telit module UE910.

Please refer to Telit's website at ***www.telit.com*** for the latest information on the HSPA+ UE910 Module.

Telit_UE910_Hardware_User_Guide
Telit_UE910_Software_User_Guide
Telit_UE910_AT_Commands_Reference_Guide

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3 OVERVIEW

3.1 Introduction

The User Manual for the Plug-In Terminus devices is intended to illustrate how users can integrate and implement the features of each communication version of the device. The common factors are explained in detail, as well as special considerations and diagrams for each module. The module differences are highlighted in this manual for design considerations for future model placement.

3.2 Preview

The Terminus Plug-In Modems are self-contained, multi-band, globally capable, M2M communication devices designed to provide a comprehensive solution to application problems for our M2M customers. They utilize the proven technology of Telit's certified modules, respectively, for their core communications engines. NavSync's MS20 module adds the flexibility of GPS to the GSM865CF only.

3.2.1 Functional Description

Cellular

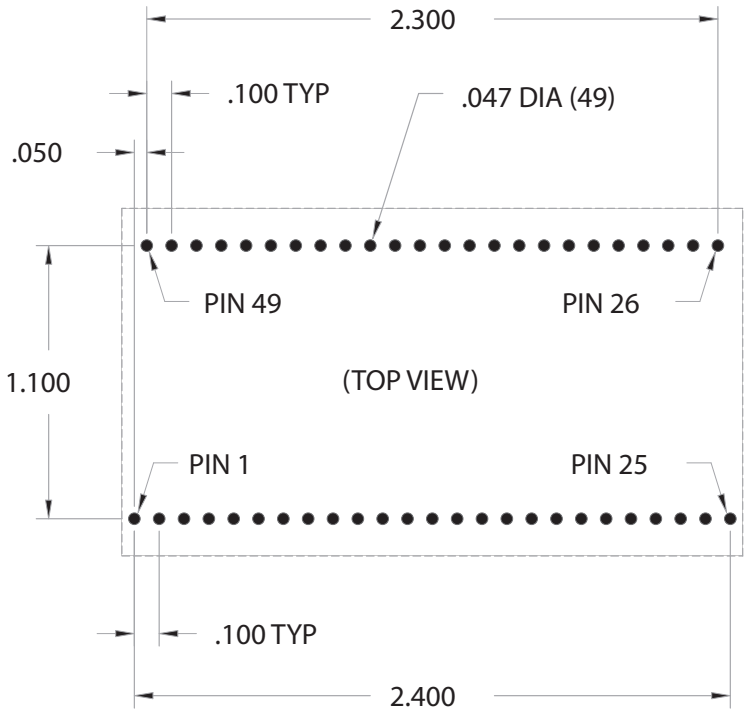
- HSPA/UMTS/EDGE/GPRS/GSM

USB

- HS/FS USB 2.0 Device (480Mb/s)

Physical Dimensions

- Length and width of all Plug-In devices are equal
- Heights of different devices will vary



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3.3 Features

- Dual Band HSPA+
  - Dual Band HSPA+ Band 850, 900, 1800, 1900 MHz
- EGPRS / WCDMA / HSDPA / HSUPA Protocol Stack 3GPP Release 7
- Control via AT commands according to 3GPP TS27.005, 27.007 and Telit customized AT commands
- Serial port multiplexer 3GPP T27.010
- SIM application Tool Kits 3GPP TS 51.014
- SIM access profile
- UDP / TCP / FTP / SMTP Stack
- SMS
- Output power
  - Class 4 (2W, 33 dBm) @ GSM 850 / 900
  - Class 1 (1W, 30 dBm) @ GSM 1800 / 1900
  - Class 3 (0.25W, 24 dBm) @ UMTS
  - Class E2 (0.5W, 27 dBm) @ EDGE 850 / 900
  - Class E2 (0.4W, 26 dBm) @ EDGE 1800 / 1900
- Sensitivity
  - -109 dBm @ 850 / 900 MHz
  - -110 dBm @1800 / 1900 MHz
  - -111 dBm @ WCDMA B1/B4/B5
- Data
  - HSPA: DL: Up to 7.2Mbps, UL: Up to 5.76Mbps
- Dimensions: 2.5" x 1.4" x 0.325"
- Operational Temperature Range: -40°C to 85°C
- Internal Switching Regulator:
  - Input Voltage Range: 3.0 to 5.25Vdc (5Vdc nominal)
  - Supply disable via terminal input pin
- Variable logic level (UART/GPIO)
  - * Adjustable from 1.8-5.0Vdc
  - * Defaults to 2.85v
- SIM Card
  - Standard locking SIM card socket
  - Optional SIM chip
- Aavailable via Hirose U.FL miniature RF connector

3.4 Block Diagram

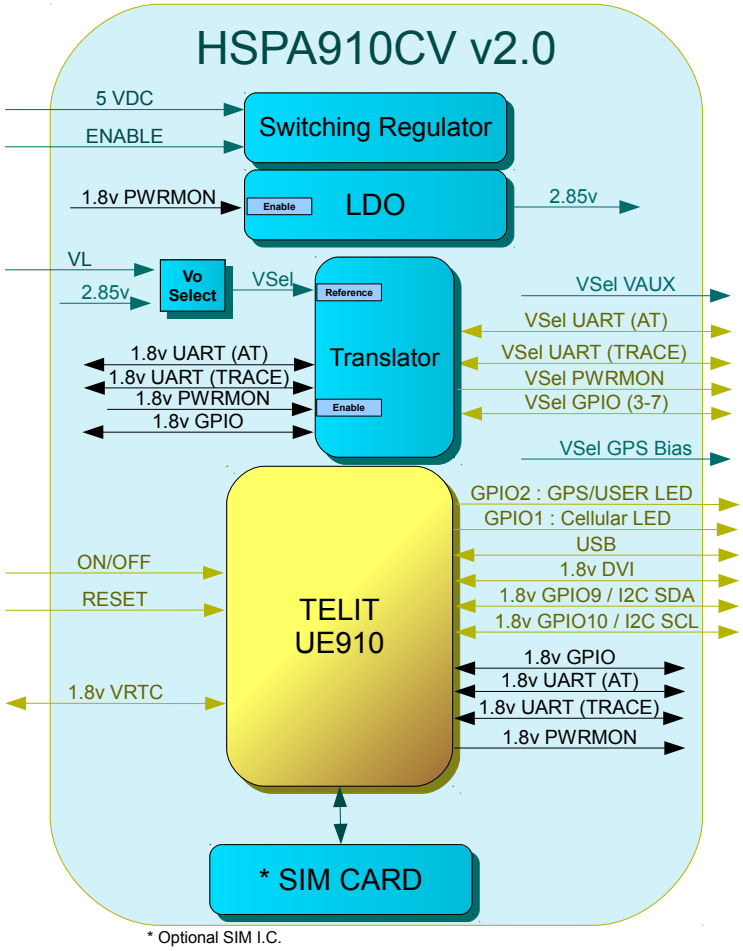

Figure 1 HSPA910CF Block Diagram

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4 INTERFACES

4.1 Interface Voltage Selection

The HSPA910CF v2.0 is equipped with a variable voltage interface solution. This allows the user to match the device to the system's level without extra hardware. Once a voltage has been injected, the unit will swap to the chosen voltage immediately for the affected I/O.

This is controlled via the VL IN signal, in which a user may inject a chosen interface voltage to utilize. This swap is done via a break-before-make mechanism when changing to or from the default voltage level, allowing for on the fly voltage changes if necessary.

The VL IN signal contains a 7M Ohm pull down resistor, and the operation of the voltage selection can be referenced as follows:

Truth Table:

VL IN	Floating	Ground	1.5v - 5.5v
VSelect	2.85v	2.85v	1.5v - 5.5v

Affected I/O:

1. UART (AT, TRACE)
2. GPIO (3-7)
3. VAUX
4. GPS Bias Voltage

VAUX Adjustment allows feedback as well as legacy access if previously utilizing a plug in implementation with VAUX as the reference. GPS Bias Voltage adjustment allows migration to a voltage that specific antennas may require that is higher than the default 2.85v.

Note to pay attention of these changes so there are no adverse effects on a previous Plug in Modem implementation.

4.1.1 UART Serial Port

The serial interface is a CMOS level UART. Default Communications settings for this port are as follows:

- Baud Rate: 115.2 kbps
- Bits: 8
- Stop Bits: 1
- Parity: None
- Hardware Handshaking: Yes

The HSPA910CF does not support autobaud, and must be changed via the AT+IPR command. It is defaulted to 115200 bps

Note: If you are not using Hardware Handshaking, please note that RTS must be connected to GROUND for proper communications where flow control is unused.

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4.1.1.1 UART Level Translation

The electrical limits for the UART are listed in the individual modem sections. Please be aware of these limits, as operating outside of them may damage the unit. If the limits must be exceeded, level translation can be used.

An example of basic translation for RXD/TXD only is found below.

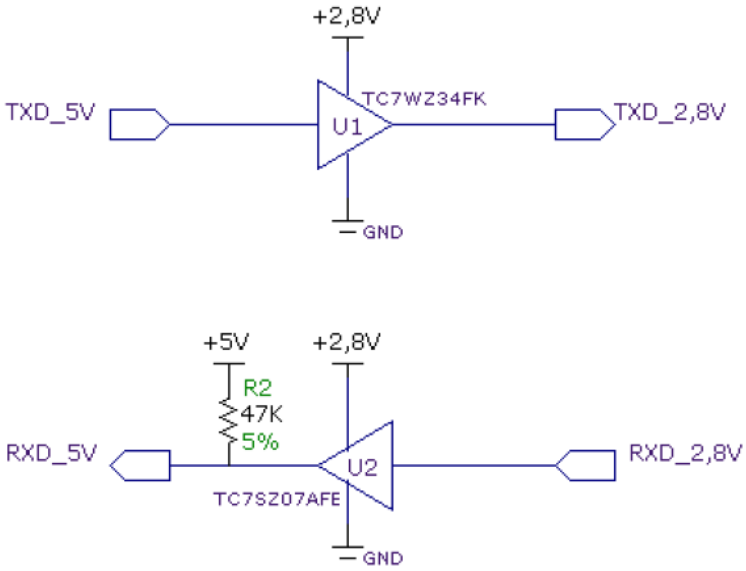

Figure 2 UART Level Translation Example

Although an external source for the level translation can be used, VAUX can be used as the reference instead. However, because some Plug-In Modems require AT commands to control VAUX, PWRMON may be used as an enable to an external reference. Do not use PWRMON directly as the reference.

4.1.2 USB Port

The Plug-In modems that are USB ready include an integrated universal serial bus (USB) transceiver, compliant with USB 2.0 specifications. High data rates for the USB enabled modems are only available over the USB interface, as the UART has a maximum baud rate of <1Mbps. In order for proper power-up of the Plug-In Modems, the USB_VBUS line MUST be disconnected until the unit is otherwise fully powered and on. If the USB_VBUS line is attached and powered before the main power is brought up and the module turned on, power sequencing issues may occur.

Note: You must implement the USB interface in order to locally update radio firmware for CDMA and UMTS applications. The GSM865CF does not have USB port available.

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4.1.2.1 USB Connection Diagram

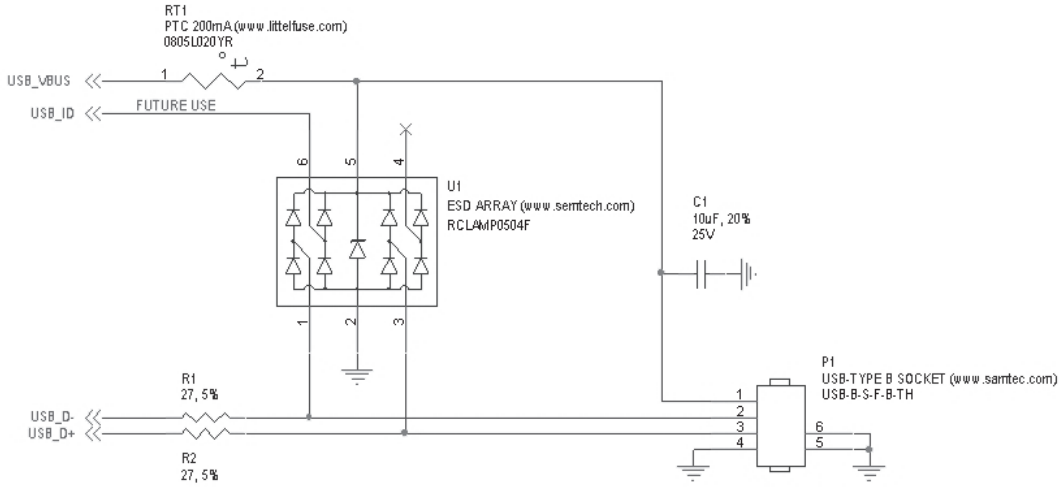

Figure 3 USB Connection Diagram

4.1.2.2 USB VBUS Switch

USB_VBUS is input, when VBUS_ENABLE is HIGH the 5v signal will be passed to TERMINUS_VBUS, turning the USB ON.

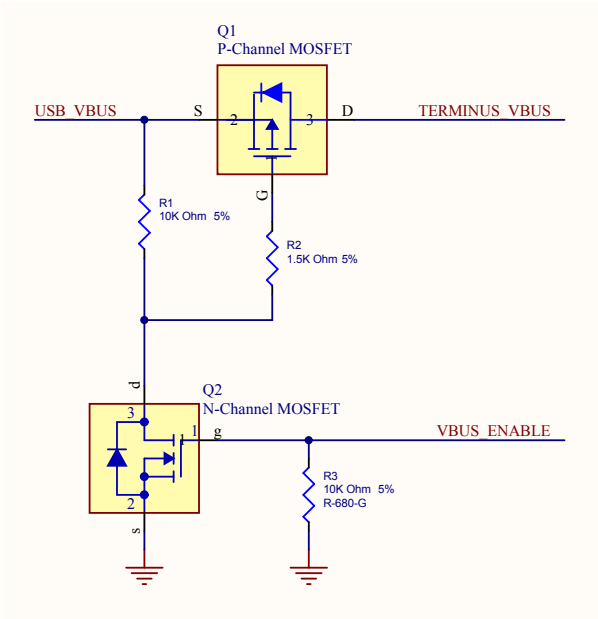

Figure 4 USB VBUS Switch Example

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4.2 Power Supply

The module's power supply accepts input voltages from 4.75Vdc to 5.25Vdc and requires a nominal current sourcing capacity of 5W (maximum 10W).

Power Supply

A good understanding of the load transients is required in order to meet the power requirements of a cellular radio. Power supply design, thermal management and layout are outside the scope of this document. Please refer to power supply manufacturers for product documentation and design application notes.

Cellular Load Transients

Cellular radios use a mix of modulation schemes including, but not limited to, TDMA and CDMA. In GSM/GPRS systems the transmission and reception of data is achieved via Time Division Multiple Access (TDMA). TDMA transmission is made up of RF bursts that cause 2A current pulses at the supply input of the cellular radio. These current pulses occur at a frequency of 216 Hz and can persist for 1.2 to 2.4ms.

On Board Regulator

This Terminus Plug-In module is designed with a switching regulator to power the cellular radio. The regulator can receive an input voltage of 3.7 to 5.25VDC to maintain regulation, but can also accept down to 3.3VDC, in which regulation is bypassed. This is useful for battery operated applications. Note that an input voltage below 4.75VDC is outside of rated specifications and thus not supported by Janus.

Note: The regulator input is capable of withstanding 6VDC Maximum. This is outside the recommended operating voltage of the Plug-In modules but but is helpful to know when designing input transient circuitry.

Plug-In Module Input Supply Requirements

The current values are given in average units due to the pulsed nature of the transmission scheme. It is recommended that your supply source the full peak current value of the transmission pulse in order to maintain proper cellular operation. The use of bulk output capacitors on your supply allows for a less powerful supply.

4.3 Audio Interface

4.3.1 HSPA910CF

The 910CF modules use a DVI audio interface which will not work with the analog audio inerface of the other Terminus Plug-In modems. The HSPA910CF supports both I2S and PCM, master and slave modes, and can use a CODEC to convert the interface to analog. Below is a block diagram based on DVI and the max 9867 CODEC with GPIO 9 and 10 being used for I2C control of the CODEC.

Please refer to the referenced DVI Application Notes for full information and example schematics utilizing the MAX9867 Audio CODEC.

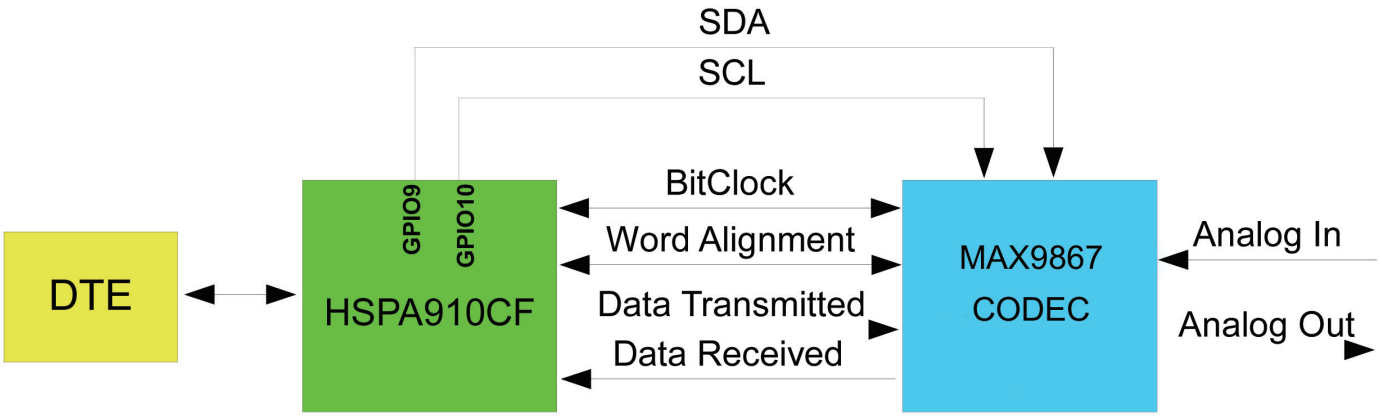

Figure 5 DVI Block Diagram

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4 Interfaces continued

4.4 Plug-In Pin-Out

PIN	PIN NAME	DESCRIPTION	STANDARD I/O SIGNAL	POWER-ON STATE	PULL TYPE	NOTE
1	SUPPLY	Positive Supply Input	Power	N/A	N/A	
2	SUPPLY	Positive Supply Input	Power	N/A	N/A	
3	ENABLE SUPPLY	Enable/Disable Supply	Input	N/A	PULL-UP to Vin: 681k	1
4	RXD	UART - Transmit Line	Output	N/A	N/A	6
5	DSR	UART - Data Set Ready	Output	N/A	N/A	6
6	CTS	UART - Clear to Send	Output	N/A	N/A	6
7	RING	UART - Ring Indicator	Output	N/A	N/A	6
8	DCD	UART - Data Carrier Detect	Output	N/A	N/A	6
9	TXD	UART - Receive Line	Input	N/A	N/A	6
10	DTR	UART - Data Terminal Ready	Input	N/A	N/A	6
11	RTS	UART - Request to Send	Input	N/A	N/A	4
12	GROUND	Supply Reference	Power	N/A	N/A	
13	TRACE_TX	Debug UART - Transmit Line	Output	N/A	N/A	6
14	TRACE_RX	Debug UART - Receive Line	Input	N/A	N/A	6
15	USER LED	USER LED	Output	N/A	N/A	6
16	CELLULAR LED	Cellular Status	Output	N/A	N/A	6
17	SERVICE	Unused	N/A	N/A	N/A	5
18	PWRMON	Power Monitor Output	Output	N/A	PULL-DOWN:1M	6
19	ON_OFF	Toggle Cellular Radio On Off State	Input	N/A	PULL-UP to VTRC: 47k	1
20	RESET	Reset Cellular Radio	Input	N/A	PULL-UP: 47k	1
21	DVI WAO	DVI Word Alignment	WCLK	N/A	N/A	6
22	DVI RX	DVI Received Data	SDIN	N/A	N/A	6
23	DVI TX	DVI Transmitted Data	SDOUT	N/A	N/A	6
24	DVI CLK	NDVI Data Clock	BCLK	N/A	N/A	6
25	GROUND	Supply Reference	Power	N/A	N/A	
26	GROUND	Supply Reference	Power	N/A	N/A	
27	USB_D-	USB Differential Data (-)	CMOS Bi-Direction	N/A	N/A	
28	USB_D+	USB Differential Data (+)	CMOS Bi-Direction	N/A	N/A	
29	USB_VBUS	USB Supply	Power	N/A	N/A	
30	VL_IN	Interface Voltage Reference	Analog Input	N/A	PULL-DOWN: 7M	3
31	I2C_SDA	12C Data	CMOS Bi-Direction	INPUT	N/A	
32	I2C_SCL	12C Clock	CMOS Bi-Direction	INPUT	N/A	
33	GPS_RX	Unused	N/A	N/A	N/A	5
34	GPS_TX	Unused	N/A	N/A	N/A	5
35	GPS_RESET	Unused	N/A	N/A	N/A	5
36	GPIO_7	General Purpose I/O	Bi-Direction	INPUT	N/A	6
37	GPIO_6	General Purpose I/O	Bi-Direction	INPUT	N/A	6
38	GPIO_5	General Purpose I/O	Bi-Direction	INPUT	N/A	6
39	GROUND	Supply Reference	Power	N/A	N/A	
40	GPIO_4	General Purpose I/O	Bi-Direction	INPUT	N/A	6
41	GPIO_3	General Purpose I/O	Bi-Direction	INPUT	N/A	6
42	GPIO_2	Unused	N/A	N/A	N/A	5
43	GPIO_1	Unused	N/A	N/A	N/A	5
44	DAC	Unused	N/A	N/A	N/A	5
45	ADC2	Unused	N/A	N/A	N/A	5
46	ADC1	Analog to Digital Converter	Analog Input	N/A	N/A	6
47	VRTC	Cellular Radio External RTC Supply	Power	N/A	N/A	
48	VAUX	Reference Voltage	Analog Output	N/A	N/A	
49	GROUND	Supply Reference	Power	N/A	N/A	

Notes:
1. It is required that this input be controlled by an Open Collector/Drain Output. Do not use an external pull-up resistor; a pull-up is included internal to the module.
2. Not currently implemented
3. VL Input may be floating or grounded if not being used.
4. RTS must be connected to GROUND if flow control is not used.
5. Not used on the HSPA910CF
6. Refer to the electrical specifications for I/O levels

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4 Interfaces continued

4.5 VRTC Details

The VRTC pin brings out the real time clock supply, which is separate from the rest of the part. This allows only the RTC to be ON when all other parts of the device are OFF. A backup capacitor can be added to this pin to increase RTC autonomy while powering the device from a battery. The CDMA910CF cannot take advantage of the VRTC functionality.
No devices should be powered from this pin.

Equations:
C = 3600 * [(Btime * IRTC)/(VRTC - VRTCmin)]
Btime = [C * (VRTC - VRTCmin)/(IRTC * 3600)]

Where:
VRTC – The Starting voltage of the capacitor (Volt)
VRTCmin – The minimum voltage acceptable for the RTC circuit. (Volt)
IRTC (Ampere) – The current consumption of the RTC circuitry when VBATT = 0
Btime - Backup Time (Hours)
C = Capacitor value (Farads)

Values for the GSM865CF/CDMA864CF/UMTS864CF
VRTC = 2.05v Nominal
VRTC minimum input voltage to function = 1.1v
IRTC = 10uA nominal

Values for the HSPA910CF
VRTC = 1.8v Nominal
VRTC minimum input voltage to function = 1.1v
IRTC = 2uA nominal

Values for the EVDO910CF
VRTC = 3.1v Nominal
VRTC minimum input voltage to function = 2.0v
IRTC = 1.1uA nominal

Values for the CDMA910CF
VRTC = N/A
VRTC minimum input voltage to function = N/A
IRTC = N/A

For Example, using the HSPA910CF numbers:
Btime = 96 hours (4 days)

C = 1.0F

4.6 GPIO Details

Terminus GPIO are configurable as input, output, and special function. Configuration is controlled by the customer specific application via AT commands. The following table describes GPIO configuration options.

GPIO	Configuration	Alternate Function	ON_OFF State
1	Input / Output	Status LED	pull-up
2	Input / Output	User LED	pull-up
3	Input / Output	N/A	pull-down
4	Input / Output	N/A	pull-down
5	Input / Output	N/A	pull-down
6	Input / Output	N/A	pull-up
7	Input / Output	N/A	pull-down

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4.6.1 Using a GPIO Pad as INPUT

The GPIO pads, when used as inputs, can be connected to a digital output of another device and report its status, provided this device has interface levels compatible with the Voltage levels of the GPIO of the module.

4.6.2 Using a GPIO Pad as OUTPUT

The GPIO pads, when used as outputs, can drive CMOS digital devices or compatible hardware. When set as outputs, the pads have a push-pull output.

4.6.3 Analog to Digital Converter

ADC	Description
1	Analog to digital converter input

4.6.4 I2C

The I2C interface is an alternate function of the modem's GPIO, for the HSPA910CF, those two signals are designated for GPIO 9 (SDA) and GPIO 10 (SCL) and are 1.8V logic level to match the DVI interface for easy usage with a codec. The signals are not pulled up on the Plug-In module and must be pulled up externally as they may also be used as spare GPIO.

Please reference the Telit AT Command Guide for details on the I2C commands.

4.6.5 ENABLE Pin

Input Logic State	Description
High-Z	Active state
0	Shutdown

Notes:

1. *It is required that this input be controlled by an open collector/drain output. Do not use an external pull-up resistor, a pull-up to VIN is included internal to the Terminus.*
2. *The ENABLE pin is offered as a means to turn off the on-board regulator for when a full power cycle is needed or an ultra low power state is required. The ENABLE pin is not intended to be used as a means of turning the Terminus off. use the ON/OFF pin to turn the Terminus on or off.*
3. *Shut down state must be held for 10ms before returning to active state.*
4. *The regulator is operational 2mS after active state is entered.*

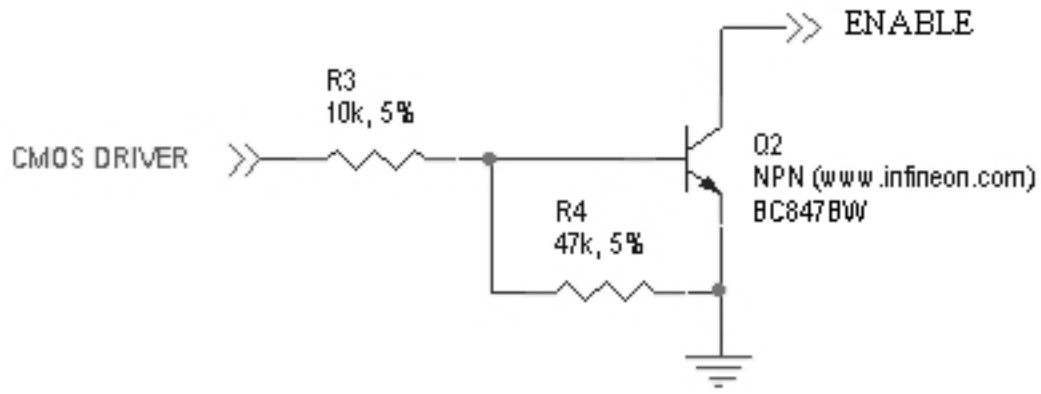

Figure 6 Enable Pin

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4.6.8 RESET Pin

Input Logic State	Description
High-Z	Active state
0	Reset state

Notes:
1. It is required that this input be controlled by an open collector/drain output. Do not use an external pull-up resistor, a pull-up is included internal to the Terminus.
2. The RESET pin is offered as a means to reset the Terminus when and if the Terminus becomes unresponsive. The RESET pin is not intended to be used as a means of turning the Terminus off. Use the ON/OFF pin to turn the Terminus on or off.
3. RESET state must be held for at least 200ms before returning to active state.

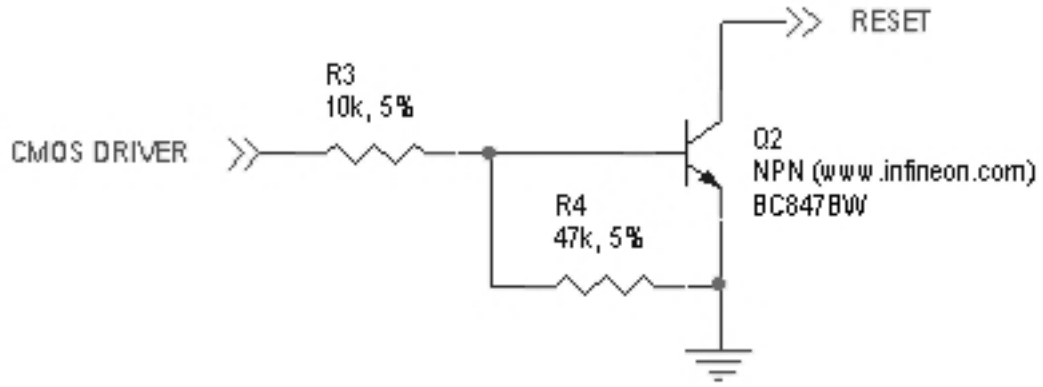

Figure 7 Reset Pin Diagram

4.6.9 ON/OFF Pin

Input Logic State	Description
High-Z	Terminus turned ON or OFF after input returns to this state.
0	Toggle Terminus ON or OFF

Notes:
1. *It is required that this input be controlled by an open collector/drain output. Do not use an external pull-up resistor, a pull-up is included internal to the Terminus.*
2. *The ON/OFF pin is offered as a means to power-on and power-down the Terminus. When the Terminus powers-down it informs the cell tower that it is powering down and will not be communicating with the tower any more. This is considered a controlled power-down.*
3. *After toggling the power state of the Terminus, wait until PWRMON indicates chosen state before toggling the power state again.*
4. *To turn ON the plug-in module, the ON_OFF input must be tied low for 3 second then released.*
5. *To turn OFF the plug-in module, the ON_OFF input must be tied low for 2 seconds then released.*
6. *Optionally the Terminus may be powered-down with the use of AT commands.*
7. *It is required to stop driving terminal inputs high when turning ON the Plug-In module by floating or bringing them low. If this is not done, power sequencing issues may occur.*

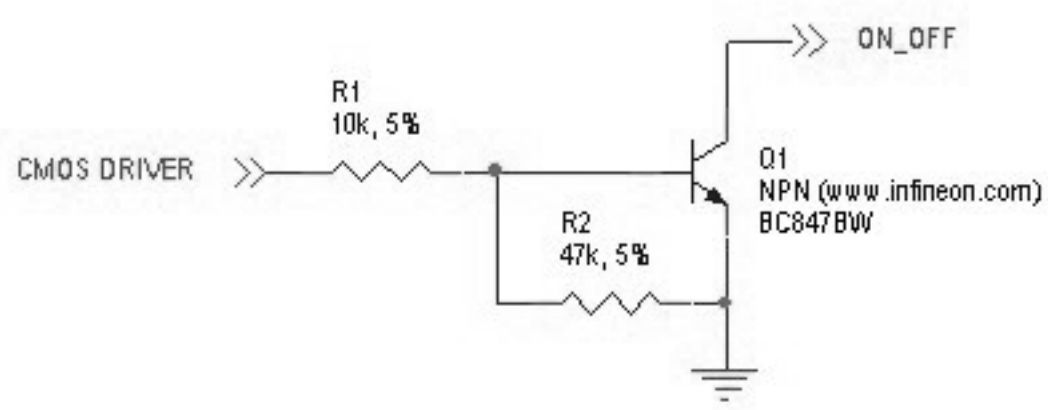

Figure 8 On / Off Pin Diagram

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4.6.10 PWRMON Pin

Output Logic State	Description
0	Terminus powered-down
1	Terminus powered-on

Notes:

1. *Used in conjunction with ON/OFF pin to control power-on and power-down state.*
2. *During a power down, it is required to stop driving terminal inputs high by floating or bringing them low. If this is not done, the PWRMON output will not transition low. On the GSM865CF and HSPA910CF, this will cause the VAUX output to remain active.*

4.6.11 VAUX

A regulator power supply output that is provided in order to supply small devices from the module itself.

When PWRMON is HIGH, VAUX will be ON. When PWRMON is LOW, VAUX will be OFF.

4.7 User LED

The HSPA910CF comes equipped with GPS functionality that is built into the cellular radios. However, the cellular radios have no GPS status output for driving an LED. Instead, this module has GPIO2 connected to the User LED pin of the Terminus. The user application can use this to control an LED or act as an additional GPIO. See figure 10 for recommended connection of an LED.

4.8 LED Status Indicators

The LED Status output is used to drive an external LED to give feedback on the current operation. See figure 10 for recommended connection of an LED. For the HSPA910CF, this is an alternate function of GPIO1 and must be set via the AT#GPIO command. The status is defined below.

4.8.1 Cellular LED Status (HSPA910CF)

LED Status	Device Status
Permanently Off	Cellular radio is off
Permanently On	On/Searching
Slow Blinking (0.3 sec on / 2.7 sec off)	Registered
Fast Blinking (0.5 sec on / 0.5 sec off)	Shutting down

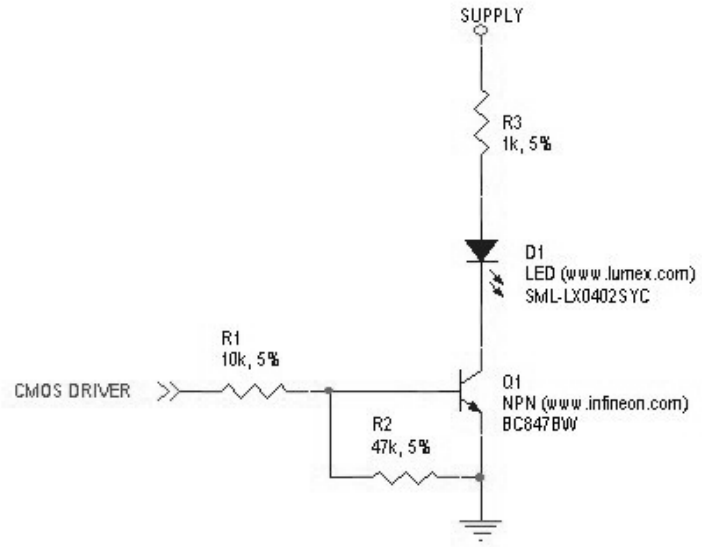

Figure 9 LED Indicators Diagram

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4.9 RF Interface

There are three RF interfaces on the HSPA910CF. A cellular, GPS, and RX diversity connector. The specifications and requirements for these are as follows:

Note: You must access the RF connections via the SMT U.FL connections if they do not include a U.FL to SMA connector. These signals are NOT electrically connected elsewhere on the board.

4.9.1 HSPA910CF Antenna Interface

Type: Hirose U.FL - MALE (Part Number: U.FL-R-SMT(10)

Pin	Description
Center Pin	RF signal
Outer Conductor	Signal ground

4.9.2 Certified HSPA+ Antenna

TBD

4.10 SIM Card Interface

The SIM Card Interface allows the Terminus to accept the subscriber card provided by the cellular telephone provider.

It can accommodate a 1.8V or 3.0V SIM card and complies with the Phase 2 GSM 11.14 standard. Optional SIM IC. Consult factory representative.

4.11 Header Interface Mounting Options

The Plug-In Modules' header pin length has been chosen to allow for direct solder mount to a PCB of standard thickness. If the user wishes to socket the Plug-In Module, they may do so as well by using the below part numbers for reference:

Samtec 25 pin header: TSM-125-04-L-SV-A
Samtec 24 pin header: TSM-124-04-L-SV-A
Mating Samtec 25 pin connector: SLW-125-01-G-S
Mating Samtec 24 pin connector: SLW-124-01-G-S

Please note there are no Samtec SMT single row mating connectors. The only mating connector available is the above listed THT version.

4.12 Screw Mounting

The HSPA910CF allows for the use of a #4 machine screw to help keep a socketed module in place where environmental variables may cause problems otherwise. If the user wishes to have a stand-off underneath the module to help alleviate possible stress from mounting hardware, below are the Janus part numbers and associated drawings for an available solution.

4-40 Hex Female Stand-off: MC-0356-G

4-40 3/16" Pan Head Phillips Machine Screw: MC-0357-G

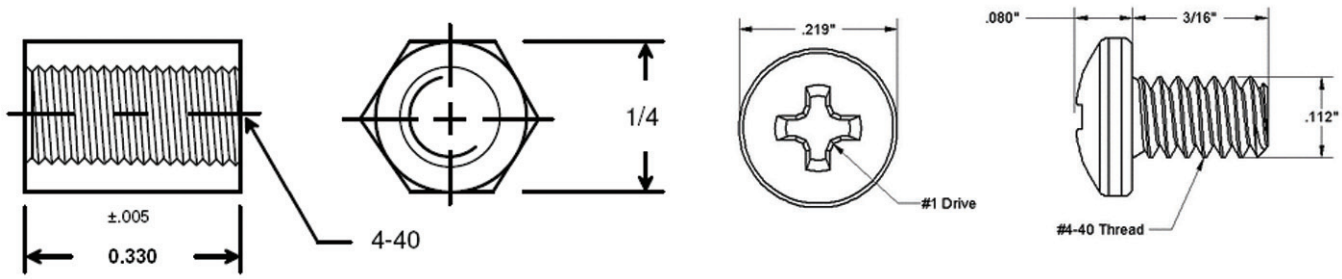

Figure 10 Screw Diagram

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5 HSPA910CF TECHNICAL SPECIFICATIONS

5.1 Electrical Specification

5.1.1 Absolute Maximum Ratings

Parameter	Min	Typ	Max	Unit	Note
VIN (DIGITAL INPUTS 2.85V CMOS)	-0.5	-	3.35	Volt	
VIN (DIGITAL INPUTS 1.8V CMOS)	-0.3	-	3.1	Volt	
Storage Temperature	-40	-	85	°C	
Supply (+) referenced to Supply (-)	0	-	6	Volt	

Operation of the device at these or any other conditions beyond those listed under Recommended Operating Conditions is not implied. Exposure to Absolute Maximum Rating conditions for extended periods of time may affect device reliability.

5.1.2 Recommended Operating Conditions

Parameter	Min	Typ	Max	Unit	Note
Temperature	-40	-	85	°C	
Supply (+) referenced to Supply (-)	4.75	5.0	5.25	Volt	
VAUX Output	-	2.85	-	Volt	
VAUX Current	-	-	100	mA	

5.1.3 Power Supply

Mode		Average (mA)	Mode Description
POWERED DOWN			
Terminal Disabled		≤ 15µA	Terminal disabled (ENABLE SUPPLY = 0)
Cellular Radio Off		0.4	Cellular module powered but switched off via ON_OFF pin (PWRMON=0)
IDLE MODE			
Mode		**Average (mA)**	**Mode Description**
GPS OFF			
AT+CFUN=1	WCDMA	13.8	Idle, no call in progress. Full functionality of the module
	GSM	13.9	
AT+CFUN=4	WCDMA	14.4	Disabled TX and RX; module is not registered on the network
	GSM	14.4	
AT+CFUN=5	WCDMA	3.4	CFUN=5 full functionality with power saving; Module registered on
	GSM	3.3	the network can receive incoming call sand SMS
AT+CFUN=7	WCDMA	10.0	CFUN=5 full functionality with power saving; Module registered on
	GSM	9.2	the network can receive incoming call sand SMS
WCDMA/HSDPA			GPS OFF in HSPA910CF
WCDMA Voice		TBD	voice channel
WCDMA data		130.2	data channel
GSM			
GSM Voice		TBD	GSM voice channel
GPRS Class 12		129.3	GPRS data channel
GPS ON			
AT+CFUN=1	WCDMA	35.5	
	GSM	37.2	Idle, no call in progress. Full functionality of the module
AT+CFUN=4	WCDMA	36.8	Disabled TX and RX; module is not registered on the network
	GSM	37.6	
AT+CFUN=5	WCDMA	28.9	Disabled TX and RX; module is not registered on the network
	GSM	30.0	
AT+CFUN=7	WCDMA	33.8	Disabled TX and RX; module is not registered on the network
	GSM	34.3	
WCDMA/HSDPA			
WCDMA Voice		TBD	WCDMA voice channel
WCDMA Data		156	WCDMA data channel
GSM			
GSM Voice		TBD	GSM voice channel
GPRS/EDGE Class 12		152	GPRS data channel

** except external active GPS antenna.*

** Data taken with USB disconnected.*

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5.1.4 I/O Levels

5.1.4.1 1.8v Standard Interface Levels (DVI, I2C, GPS LED)

Parameter	Min	Typ	Max	Unit	Note
Input Voltage High - Vih	1.5	-	1.9	Volt	
Input Voltage Low - Vil	0	-	0.35	Volt	
Output Voltage High - Voh	1.6	-	1.9	Volt	
Output Voltage Low - Vol	0	-	0.2	Volt	
Typical Current Source/Sink = 100uA/1uA					

5.1.4.2 2.85v Standard Interface Levels (UART, GPIO)

Parameter	Min	Typ	Max	Unit	Note
Input Voltage High - Vih	1.85	-	2.85	Volt	
Input Voltage Low - Vil	0	-	0.99	Volt	
Output Voltage High - Voh	2.45	-	2.85	Volt	
Output Voltage Low - Vol	0	-	0.4	Volt	
Typical Current Source = 100uA/1uA					

5.1.4.3 VL IN Selected Interface Levels (UART, GPIO)

Parameter	Min	Typ	Max	Unit	Note
Input Voltage High - Vih	VL*0.65	-	VL	Volt	
Input Voltage Low - Vil	0	-	VL*0.35	Volt	
Output Voltage High - Voh	VL-0.4	-	VL	Volt	
Output Voltage Low - Vol	0	-	0.4	Volt	

5.1.4.4 Cellular LED Output Levels

Parameter	Min	Typ	Max	Unit	Note
Output Voltage High - Voh	1.6	-	1.9	Volt	
Output Voltage Low - Vol	0	-	0.2	Volt	
Typical Current Source = 100uA					

5.1.4.5 ADC Input Levels

Parameter	Min	Typ	Max	Unit	Note
Input Voltage Range	0	-	1.2	Volt	
AD Conversion	-	-	10	Bits	
Input Resistance	1M	-	-	Ohm	
Input Capacitance	-	1	-	pF	

5.1.4.6 Reset Pin Input Levels

Parameter	Min	Typ	Max	Unit	Note
Input Voltage High - Vih	1.5	-	1.9	Volt	
Input Voltage Low - Vil	0	-	0.35	Volt	

It is required that this input be controlled by an Open Collector/Drain Output. Do not use an external pull-up resistor, a pull-up is included internal to the Terminus.

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5.1.5 HSPA+ Cellular Antenna Specifications:

5.1.5.1 Antenna Specifications

Parameter	Description
Frequency Range	Depending on frequency bands provided by the network operator, the customer should use the most suitable antenna for those frequencies.
Bandwidth	70MHz in GSM850 140 MHz PCS 140MHz in WCDMA Band 2 70MHz in WCDMA Band 5
Gain	Gain < 3dBi
Impedance	50Ω
Input Power	>33 dBm (2W) peak power in GSM >24 dBm Average power in WCDMA
VSWR Absolute Max	≤ 10:1
VSWR Recommended	≤ 2:1

5.1.6 USB Transceiver Specifications

Parameter	Comments	Min	Typ	Max	Unit
USB_VBUS					
Supply voltage		4.5	5.0	5.25	Volt
Supply current				25	mA
Input levels for low-/full speed					
Receiver threshold (single-end)		0.8	-	2.0	Volt
Differential input sensitivity	|D+ - D-|, Vin = 0.8V to 2.5V	0.2	-	-	Volt
Differential common-mode range	Includes VDI	0.8	-	2.5	Volt
Output levels for low-/full speed					
Low	RL = 1.5 kΩ to 3.6 V	-	-	0.3	Volt
High	RL – 15 kΩ to GND	2.8	-	3.6	Volt
Output signal crossover voltage		1.3	-	2.0	Volt
Terminations					
Internal pull-up resistor	VTRM to D+, VTRM to D-	1.425	1.5	1.575	kΩ
Internal pull-down resistor	D= to GND, D- to GND	14.3	15	24.8	kΩ
High-Z state output impedance	0 V< VDD< 3.6 V; measured at D+ and D- pins to GND	300	-	-	kΩ
Termination voltage	An internal supply voltage, VTRM	3.0	3.3	3.6	Volt
Driver characteristics – full speed					
Transition time:					
Rise time	CL = 50 to 125 pF	4	-	20	ns
Fall time	CL – 50 to 125 pF	4	-	20	ns
Rise/fall time matching		90	-	111	%
Series output resistance	D+, D-	28	33	44	Ω
Driver characteristics – low speed					
Transition time:					
Rise time	CL = 50 to 600 pF	75	-	300	ns
Fall time	CL – 50 to 600 F	75	-	30	ns
Rise/fall time matching		80	-	125	%

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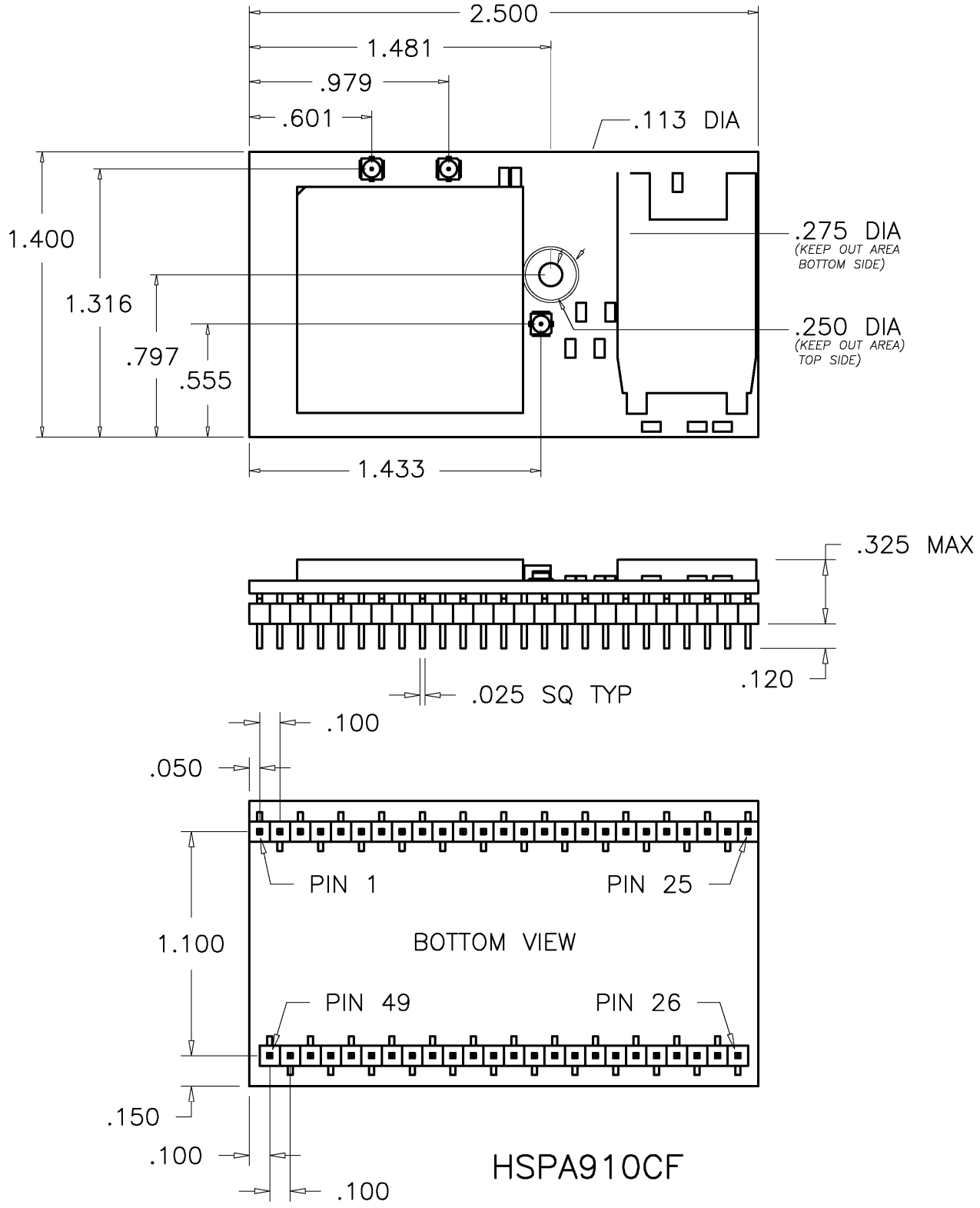

Figure 11 HSPA910CF Mechanical Dimensions

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5.3.1 Set Up

To interface with the module, connect the serial interface to a PC and use a terminal emulation program such as Microsoft® Hyperterminal. Set the interface parameters as follows:

- Baud Rate: 115.2 kbps
- Bits: 8
- Stop Bits: 1
- Parity: None
- Hardware Handshaking: Yes

5.3.1.1 Test the Emulator Set Up

- Enter AT<cr> from terminal and wait for OK

Note that Autobaud is not supported on the HSPA910CF Terminus. If you are utilizing the serial interface and you wish to change the baud rate on the module, you must use AT+IPR. You must also change the rate in the host UART (i.e. HyperTerminal) to match the new baud rate. If these do not match you will not be able to send AT commands to the module through the serial port. The Terminus is by default set to 115.2 kbps.

5.3.1.2 Verify Your Terminal and Firmware Version

- Enter AT+CGMM and wait for the response
  The response will be the Telit module's model number without a command echo.
- Enter AT+CGMR and wait for the response
  The response will be the Telit module's current firmware without a command echo.

Please confirm your model and firmware with the one listed in section 2.1

5.3.2 Powering ON/OFF

5.3.2.1 Turn the module ON through the following method:

- Pull ON/OFF signal (Pin 19) to ground for three (3) seconds, then release.

The Terminus module is fully operational after 4 seconds. Logging onto a network may take longer than this and is outside the control of the Terminus.

5.3.2.2 There are two ways to switch OFF the module as described below.

- Use the appropriate AT command (AT#SHDN)
- Pull ON/OFF signal (Pin 19) to ground for three (3) seconds, then release.

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5.3.3 Setting Up Service – Network Settings

5.3.3.1 Set Up

The network settings for the Terminus will vary depending on the cellular carrier you are using. Below are settings that can be used for most North American configurations:

- AT#SELINT=2 //use of most recent AT command set
- AT#ENS=1 // AT&T/Cingular configuration (SAT, BND, AUTONBND, PLMNMODE, plus Cingular® specific ENS requirements)

If Terminus is being used in a different country or with a different carrier please refer to Telit AT command refer¬ence document regarding the use of the AT#BND command to set the proper frequency band).

Important: After entering either of the sets of settings above power the Terminus OFF and then ON. It is now ready for use.

5.3.3.2 Check Network Status (assuming you have a valid SIM card installed)

Enter AT+CREG? <cr> And wait for response.

Response will be +CREG:0,1 or +CREG: 0,5 meaning the device is registered to the home network or roaming, respectively. If response is different than this, please refer to the Telit AT command reference document for more information.

5.3.3.3 Check Signal Quality

Enter AT+CSQ<cr> And wait for response +CSQ:<rssi>,<ber>

<rssi>	Signal Strength
99	Not known or not detectable
0-31	dBm = (rssi * 2) –113

Example: A result of 31 indicates -51dBm or greater.

An rssi value of >=10 in typical applications is fine and you will usually see about 12-20 in normal to good signal, but note that worst case it can be lower, still register and perform normal functions.

5.3.4 Making a Voice Call

5.3.4.1 Set Up

Voice call mode allows you to use a telephone handset to communicate with a properly equipped subscriber unit.

- Set the call mode to voice
  Enter AT+FCLASS=8<cr> and wait for response OK
- Dial the phone number
  Enter ATD <8885551234>; <cr>
- To disconnect the call enter ATH<cr>

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5.3.5 Sending an SMS

5.3.5.1 Set Up

SMS (Select Message Service) mode allows you to send a text message (max 160 characters) to a SMS capable subscriber unit.

- Set the SMS mode to text. This must be entered every power cycle.
  AT+CMGF=1<cr>
- To enter the receiving subscriber unit phone number and message enter:
  AT+CMGS="8885551234"
  Wait for response">" then enter message text
  Enter "ctrl z" <cr> to end the message

5.3.6 Making a GPRS Data Call

5.3.6.1 Set Up

GPRS is a data service that uses Packet Data Protocol (PDP).

- Set up the PDP context parameters
  Enter AT+CGDCONT=1, "IP", "APN", "0.0.0.0",0,0<cr>
  Where APN is specific to the service provider being used.
- Activate the PDP context
  Enter AT#SGACT=1,1,"v", "p"
  Where v is your user ID and p is your password.
  If these are not set replace with "","""
- Open the socket connection
  Enter AT#SD=1,0,IPP,IPA,0,0,0
  Look for response "CONNECT". This opens a remote connection via socket
  IPP = the remote host port of the server you are trying to connect to. (0 to 65535)
  IPA = the IP address of the server hyou are trying to connect to in the format:
  "xxx.xxx.xxx.xxx"
- At this point a data session is active and data can be sent from the Terminus to the remote device and visa versa.
- To exit the data session and return to command mode, send the characters"+++" and wait for the OK response
- Enter AT#SH=1 to close the socket

5.3.7 Further Instructions

On utilizing different commands for other applications than those described here, please refer to these reference documents, listed in section 2.1

- Telit UE910 AT Commands Reference Guide
- Telit UE910 Software User Guide

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6 DESIGN CONSIDERATIONS

6.1 Minimum Required Module Pin Connects

HSPA+ Pin Functions

Pin	Signal	Function	Note
1	VBATT	Main power supply	
2	VBATT	Main power supply	
12	GND	Ground	
25	GND	Ground	
26	GND	Ground	
39	GND	Ground	
49	GND	Ground	
9	TXD	Serial data input (TXD) from DTE	
4	RXD	Serial data output to DTE	
11	RTS	Input for request to send signal (RTS) from DTE	2
19	ON/OFF	Input command for switching power ON or OFF(toggle command)	
20	RESET	Reset input	

Note:

1. *If the application uses USB as the main interface to the module, this is sufficient to capture any debug or trace data, provided the application can export the diagnostic port externally.*
2. *RTS must be connected to ground if flow control is not used.*

6.2 Debug:

Debug of the Plug-In Modems in production

To test and debug the mounting of the module, we strongly recommend test pads on the host PCB. This will allow verification of the connection between the module itself and the application and to test the performance of the module connecting it with an external computer.

Depending on the customer application, these pads include, but are not limited to the following signals:

- TXD
- RXD
- ON/OFF
- RESET
- GND
- VBATT
- TX_TRACE
- RX_TRACE
- PWRMON
- USB D+
- USB D-
- USB V_BUS
- USB_ID

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APPENDICES

Approvals

AT&T Certification
PTCRB Certification
FCC Certified
CE Certified

Safety Recommendations (for Information only)

Antenna Care and Replacement

Do not use the Terminus with a damaged antenna.
Buy the antenna from an approved suppliers list. Using unauthorized antennas, modifications, or attachments could damage the Terminus and may violate local RF emission regulations or invalidate type approval.

Abbreviations

3GPP	3rd Generation Partnership Project
AC	Alternating Current
ADC	Analog To Digital Converter
BER	Bit Error Rate
CD	Carrier Detect
CDMA	Code Division Multiple Access
CSD	Circuit Switched Data
CTS	Clear To Send
DB	Decibel
DBFS	Decibels Full Scale
DC	Direct Current
DCE	Data Communications Equipment
DSR	Data Set Ready
DTMF	Dual-tone multi-frequency
DTR	DTE Ready
FDN	Fixed Dialing Number
GPIO	General Purpose Input Output
GPRS	General Packet Radio Service
GSM	Global System Mobile
ITAR	International Traffic In Arm Regulation
LED	Light Emitting Diode
M2M	Machine To Machine
PBCCH	Packet Broadcast Control Channel
PDU	Protocol Data Unit
RF	Radio Frequency
RI	Ring Indicator
RSSI	Received Signal Strength Indication
RTS	Request To Send
RxD	Received Data
SMS	Short Message Service
TTFF	Time To First Fix
TxD	Transmitted Data
UICC	Universal Integrated Circuit Card
UMTS	Universal Mobile Telecommunications System
USIM	Universal Subscriber Identity Module
USSD	Unstructured Supplementary Service Data
VSWR	Voltage Standing Wave Ratio
WAAS	Wide Area Augmentation System

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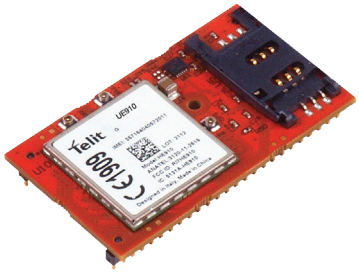
Terminus Plug-In Products User Manual



Ordering Information

Ordering Information	Description
HPSA910CF v2.0	Terminus HSPA+ Plug-In Modem

Revision History

Revision	Revision Date	Note
P00	09/30/15	HPSA910CF v2.00 Release

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